Leica GS09
User Manual

Version 2.0
English

- when it has to be **right**

Leica Geosystems

Introduction

Purchase

Congratulations on the purchase of a Leica GS09 system.

This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "9 Safety Directions" for further information.
Read carefully through the User Manual before you switch on the product.

Product identification

The type and serial number of your product are indicated on the type plate.
Enter the type and serial number in your manual and always refer to this information when you need to contact your agency or Leica Geosystems authorised service workshop.

Type: _____

Serial No.: _____

Symbols

The symbols used in this manual have the following meanings:

Type	Description
⚠ **Danger**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **Warning**	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
⚠ **Caution**	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury and/or appreciable material, financial and environmental damage.
☞	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Trademarks

- Windows is a registered trademark of Microsoft Corporation in the United States and other countries
- CompactFlash and CF are trademarks of SanDisk Corporation
- Bluetooth is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to the Leica GS09 GNSS.

Available documentation

Name	Description/Format		
GS09 User Manual	All instructions required in order to operate the product to a basic level are contained in the User Manual. Provides an overview of the product together with technical data and safety directions.	✓	✓

Name	Description/Format		
GS09 Quick Guide	Describes the general working of the product in standard use. Intended as a quick reference field guide.	✓	✓
GS09 Technical Reference Manual	Overall comprehensive guide to the product and application functions. Included are detailed descriptions of special software/hardware settings and software/hardware functions intended for technical specialists.		✓

Refer to the following resources for all Leica GS09 documentation/software:

- the Leica GS09 CD-ROM
- https://myworld.leica-geosystems.com

CD-ROM contents

The Leica GS09 CD-ROM contains software and documentation specific to Leica GS09:

Type	Description
Software	System software
	Language software
	Application programs
Documentation	Leica GS09 User Manual
	Leica GS09 Quick Guide
	Leica GS09 Technical Reference Manual
	Leica GS09 Equipment List
	Leica GS09 Product Brochure
	Leica GS09 Technical Data Sheet

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With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you, 24 hours a day, 7 days per week. This increases your efficiency and keeps you and your equipment instantly updated with the latest information from Leica Geosystems.

Service	Description
myProducts	Simply add all Leica Geosystems products that you and your company own. View detailed information on your products, buy additional options or Customer Care Packages (CCPs), update your products with the latest software and keep up-to-date with the latest documentation.
myService	View the service history of your products in Leica Geosystems Service Centers and detailed information on the services performed on your products. For your products that are currently in Leica Geosystems Service Centers view the current service status and the expected end date of service.
mySupport	Create new support requests for your products that will be answered by your local Leica Geosystems Support Team. View the complete history of your Support and view detailed information on each request in case you want to refer to previous support requests.

Service	Description
myTraining	Enhance your product knowledge with the Leica Geosystems Campus - Information, Knowledge, Training. Study the latest online training material or download training material on your products. Keep up-to-date with the latest News on your products and register for Seminars or Courses in your country.

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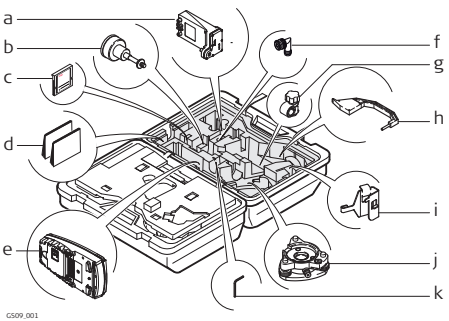
1 Unpacking the Container

1.1 Leica GS09 Container Contents

Description

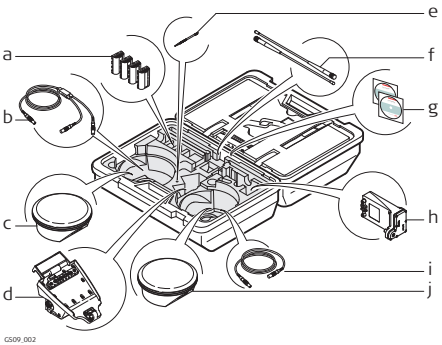
The main components required for the Leica GS09 are combined in one transport container.

Container for Leica GS09 and delivered accessories part 1 of 2



a) GFU modem
b) GRT146 carrier
c) CF card
d) Manuals
e) CS09 field controller
f) 90° antenna adapter
g) GHT63 pole clamp
h) Height hook
i) GHT58 tripod bracket for GFU modem
j) Tribrach
k) Bubble adjusting key

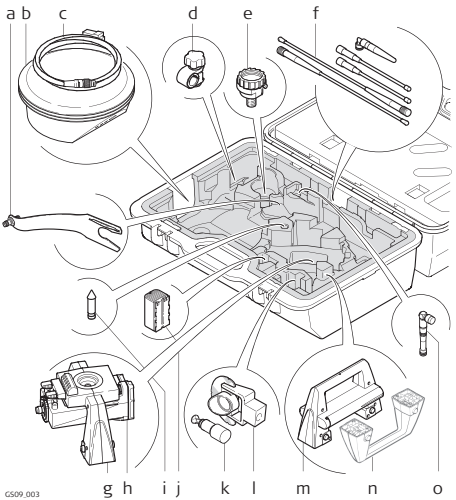
Container for Leica GS09 and delivered accessories part 2 of 2



a) GEB211/GEB212 batteries
b) GEV205 Y-cable
c) GS09 antenna
d) GHT56 holder
e) Spare stylus
f) Antennas
g) CD-ROM
h) GFU modem
i) GEV234 data cable
j) GS09 antenna

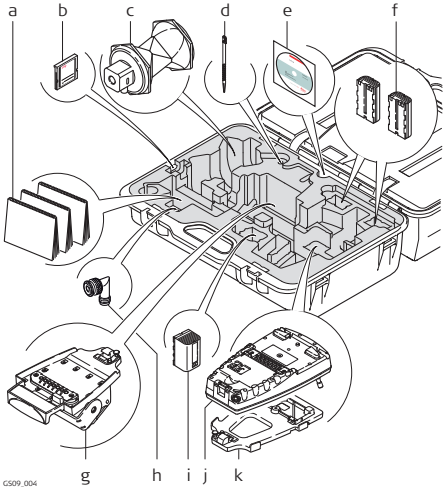
1.2 SmartStation Container Contents

Container for SmartStation and delivered accessories part 1 of 2



a) GAD33 arm 15 cm
b) GS09 antenna
c) Cables
d) GHT63 pole clamp
e) GAD31 adapter
f) Antennas
g) GAD104 SmartAntenna adapter
h) GFU modem
i) Mini prism spike
j) GEB221 battery
k) GRZ101 mini prism and GAD103 adapter
l) GMP101 mini prism
m) RH1200 RadioHandle
n) Instrument carry handle
o) GAT 15 antenna

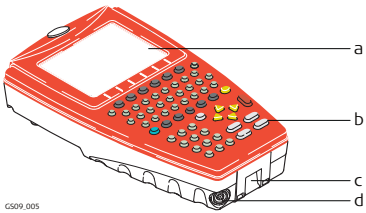
Container for SmartStation and delivered accessories part 2 of 2



a) Manuals
b) CompactFlash card
c) GRZ4 / GRZ122 prism
d) Spare stylus
e) CD-ROM
f) GEB211 / GEB212 batteries
g) GHT56 holder
h) 90° antenna adapter
i) GEB221 battery
j) CS09 field controller
k) GHT39 holding plate

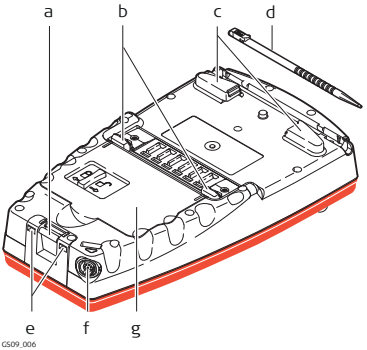
1.3 Components of the CS09 Field Controller

Upside of CS09 field controller



a) Touch screen
b) Keyboard
c) Hand strap bottom clips
d) LEMO port, with integrated USB port and power

Underside of CS09 field controller

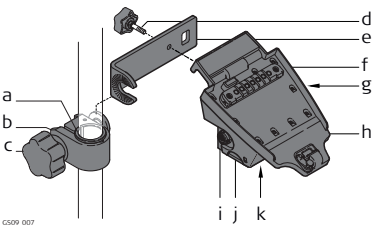


a) Spring clip for pole holder
b) Top clips for pole holder
c) Hand strap top clips
d) Stylus for touch screen
e) Hand strap bottom clips
f) Integrated USB and power port
g) Battery and CompactFlash card compartment

Bluetooth ports are included inside the CS09 field controller, for connectivity to GS09 antenna and cellular phones.

1.4 Components of the GHT56 Holder and GHT63 Clamp

Components of the GHT56 holder and GHT63 clamp



GHT63 clamp

a) Plastic sleeve
b) Pole clamp
c) Clamp bolt

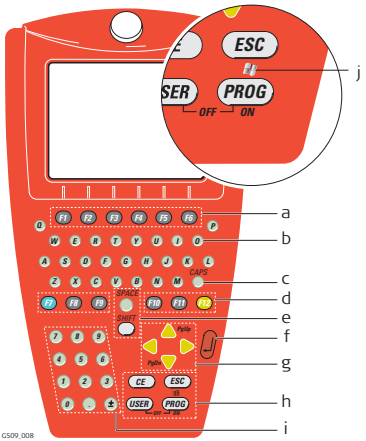
GHT56 holder

d) Tightening screw
e) Mounting arm
f) Clip-on-contacts for connecting CS09 field controller
g) LED
h) Mounting plate
i) Port for connecting GFU modem
j) Locking mechanism for battery
k) Battery compartment

2 Using the CS09 Field Controller

2.1 The Keyboard

Keyboard display



a) Function keys **F1**-**F6**
b) Alpha keys
c) **CAPS**
d) Hot keys **F7**-**F12**
e) **SPACE**, **SHIFT**
f) **ENTER**
g) Arrow keys
h) **CE**, **ESC**, **USER**, **PROG**
i) Numeric keys
j) Windows key symbol.

Special Keys

Key	Function
Hot keys **F7**-**F12**	User definable keys for access to any application, configuration or function.
PROG (**ON**)	If the field controller is off: press and hold for 2 s to turn it on. If the field controller is on: press at any time to access the Programs screen, where a program can be selected.
USER	User definable menu for quick access anytime and access to all STATUS panels.

Other Keys

Key	Function
CAPS	Switches between upper case and lower case letters.
CE	Clears all entry at the beginning of user input. Clears the last character during user input.
ENTER	Selects the highlighted line and leads to the next logical menu / dialogue. Starts the edit mode for edit fields. Opens a choicelist.

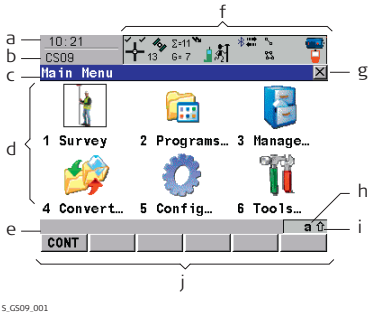
Key	Function
ESC	Leaves the current menu or dialogue without storing any changes. Turns field controller off when held for 2 s in the Main Menu screen.
SHIFT	Switches between the first and the second level of function keys.
SPACE	Enters a blank.
Arrow keys	Moves the focus on the screen.
Alpha keys	To type letters.
Function keys **F1**-**F6**	Correspond to six softkeys that appear on the bottom of the screen when the screen is activated.
Numeric keys	To type numbers.

Key combinations

Key	Function
PROG plus **USER**	Turns field controller off when held in the Main Menu screen.
SHIFT ▲	Pages up.
SHIFT ▼	Pages down.
SHIFT PROG ( )	Displays the Windows CE task bar and start menu.

2.2 The Screen Display

Screen



a) Time
b) Caption
c) Title
d) Screen area
e) Message line
f) Icons
g) ESC ☒
h) CAPS
i) SHIFT icon
j) Softkeys

Elements

Type	Description
Time	The current local time is shown.
Caption	Shows location either in the Main Menu screen, under **PROG** key or **USER** key.
Title	Name of the screen is shown.

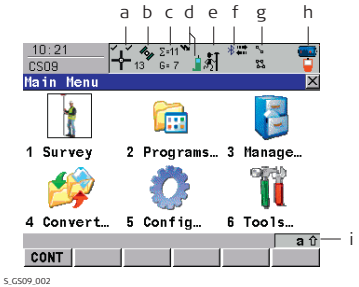
Type	Description
Screen area	The working area of the screen.
Message line	Messages are shown for 10 s.
Icons	Shows current status information of the field controller. Can be used with touch screen to access the subsequent screen.
ESC ☒	Can be used with touch screen. Same functionality as the **ESC** fixed key. The last operation will be undone.
CAPS	The caps mode for upper case letters is active. The caps mode is activated and deactivated by pressing **UPPER (F5)** or **LOWER (F5)** in some screens.
SHIFT icon	Shows the status of the **SHIFT** key; either first or second level of softkeys is selected. Can be used with touch screen and has the same functionality as the fixed key **SHIFT**.
Softkeys	Commands can be executed using **F1** - **F6** keys. The commands assigned to the softkeys are screen dependent. Can be used directly with touch screen.

2.3 The Icons - Showing Field Controller Status

Description

Icons show information about the current status of the field controller.

Position of the icons on the screen



a) Position status
b) Number of visible satellites
c) Contributing satellites
d) Real-time status
e) Position mode
f) Bluetooth
g) Data management
h) Battery and memory
i) **SHIFT**

Position status

Displays the status of the current position.
Touch screen: Tapping the icon leads to **STATUS Position**.

Icon	Description
No icon	No position available.
	Autonomous solution available.
	Code solution available.
	Phase fixed solution available. The ticks indicate that an ambiguity check is being made.

Number of visible satellites

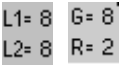
Displays the number of theoretically visible satellites above the configured cut off angle according to the current almanac.
Touch screen: Tapping the icon leads to **STATUS Satellites**.

Icon	Description
	The number of visible satellites.

Contributing satellites

Displays the number of satellites that are contributing to the currently computed position solution.

Touch screen: Tapping the icon leads to **STATUS Satellites**.

Icon	Description
	When a position status icon is displayed, the number of satellites currently used for the position computation are shown. If no position is currently available but satellites are being tracked then the L1 and L2 values (GPS only) or the G and R values (GPS & GLONASS) show how many satellites are being tracked. ☞ The number of contributing satellites can differ from the number of visible satellites. This may be either because satellites cannot be viewed or the observations to these satellites are considered to be too noisy to be used in the position solution.

Icon	Description
	The number of contributing GLONASS satellites could be zero if five or more GPS satellites are used for the position computation. The processing algorithm automatically selects the best possible set of satellite combinations for the position computation. A position computation with R = 0 is certainly within the specified reliability.

Real-time device and real-time status

Displays the real-time device configured to be used and its status.
Touch screen: Tapping the icon leads to **STATUS Real-Time Input**.

Real-time mode: Reference
An arrow pointing up indicates a reference configuration, it does not indicate if the device is working. The arrow flashes when a real-time message is sent. When two real-time devices are configured, then the icon for the real-time 1 device is shown.

Icon	Description
	Radio transmitting.
	Digital cellular phone connecting.

Icon	Description
	Digital cellular phone transmitting.

Real-time mode: Rover
An arrow pointing down indicates a rover configuration. The arrow flashes when real-time messages are received.

Icon	Description
	Radio receiving.
	Digital cellular phone connecting.
	Digital cellular phone receiving.

Internet online status

Icon	Description
	Field controller is online in the Internet.

Position mode

Displays the current position mode depending on the configuration defined. Symbols are added to the basic position mode icon when logging of auto points is configured. As soon as this icon becomes visible the field controller is in a stage where practical operation can commence.

Icon	Position mode	Point occupation	Logging of auto points	Move antenna
	Static	Yes	No	No
	Moving	No	No	Yes
	Moving	No	By time	Yes
	Moving	No	By distance or height or by user decision	Yes
	Moving	No	By stop & go	Yes

Bluetooth

The status of each Bluetooth port and any Bluetooth connection is displayed.
Touch screen: Tapping the icon leads to **STATUS Bluetooth**.

Icon	Description
	Bluetooth is integrated.
	A Bluetooth connection is established and active.

Data management

The number of lines and areas currently open in the active job is displayed.
Touch screen: Tapping the icon leads to **MANAGE Data: Job Name**

Icon	Description
	The number of lines and areas currently open.

Battery icons

The status of the battery is displayed. The remaining power in the battery is indicated by six levels.
Touch screen: Tapping the icon leads to **STATUS Battery & Memory**.

Icon	Description
	Internal battery is in use.
	External battery attached and in use.

SHIFT

The status of the **SHIFT** key is displayed.
Touch screen: Tapping the icon shows additional softkeys.

Icon	Description
	Additional softkeys are available in the currently visible screen.
	The **SHIFT** key has been pressed.

2.4 The Symbols - Showing Field Controller Settings

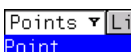
Description

Symbols show information about current field controller settings.

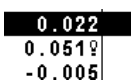
Attributes

Symbol	Description	Example
	The attribute symbol is displayed in the MANAGE Codes screen to indicate codes that have attributes attached.	

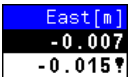
Filter

Symbol	Description	Example
	The filter symbol is shown on the Points page if a stakeout filter is active.	

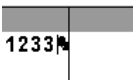
Limits

Symbol	Description	Example
	The limits symbol indicates that a defined limit has been exceeded. For example, the exceeding of a residual limit in the Determine Coordinate System program.	

Largest residual

Symbol	Description	Example
!	The largest residual symbol is used to indicate the largest residual in the Determine Coordinate System program - DET C SYS Step 4: Check Residuals.	

Staked out

Symbol	Description	Example
⚑	The staked out symbol is used in the MANAGE Data: Job Name screen to indicate points which have been staked out.	

3 Using the GS09 Antenna

3.1 Understanding Antenna Heights

Description

- The height of the GNSS antenna above the point consists of three components:
  - the vertical height reading,
  - the vertical offset,
  - the vertical phase centre variations.
- For most operations, pre-configured antenna settings in CS09 field controller can be used. These settings take the vertical phase centre variations into account.

MRP

Leica GS09 accepts vertical height readings to the **M**echanical **R**eference **P**lane, MRP.

Vertical phase centre variations

These are handled automatically in the standard antenna records. The antenna calibrations to determine the phase centre variations were executed by Geo++® GmbH.

Pillar setup. For other than the GRT146 carrier, the dimensions must be determined and the vertical offset must be adapted.

Tripod setup. For height measurement devices other than the height hook, the dimensions must be determined and the vertical offset must be adapted.

Pole setup. For other than Leica poles, the dimensions must be determined.

3.2 The Mechanical Reference Plane, MRP

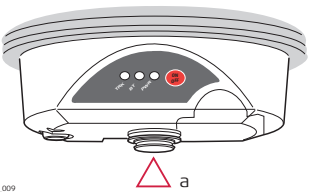
Description

The **M**echanical **R**eference **P**lane:

- is where the antenna heights are measured to.
- is where the phase centre variations refer to.
- varies for different antennas.

MRP for GS09 antenna

The MRP for the GS09 antenna is shown in the diagram.

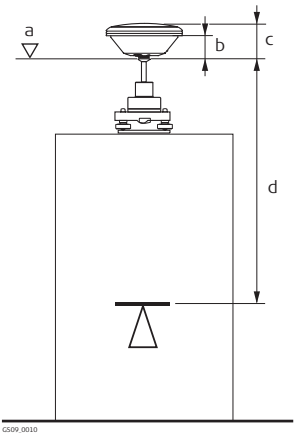


a) The mechanical reference plane is the underside of the threaded metal insert.

3.3 Measuring the Antenna Height for a Pillar Setup

Measuring the antenna height, a quick overview

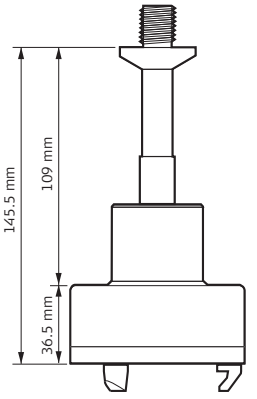
Setup type	Antenna name	The required measurement
Pillar	GS09 Pillar	the vertical height reading to the MRP.



a) Mechanical reference plane MRP
b) Vertical phase centre offset for L1
c) Vertical phase centre offset for L2
d) **Vertical Height Reading**

The Vertical offset = 0.00

Determining the antenna height with the GRT146 carrier step-by-step

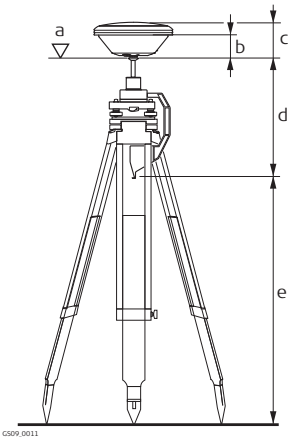
Step	Description
1.	Measure a height from the pillar benchmark to a surface on the carrier. 

Step	Description
2.	Use the appropriate measurement from the diagram above, to determine the height difference between the measured surface on the carrier and where the MRP of the GS09 antenna sits on the carrier.
3.	The vertical height reading = adding the values in step 1. and step 2.

3.4 Measuring the Antenna Height for a Tripod Setup

Measuring the antenna height, a quick overview

Setup Type	Antenna type	The required measurement
Tripod	GS09 Tripod	the vertical height reading from the height hook.



a) Mechanical reference plane MRP
b) Vertical phase centre offset for L1
c) Vertical phase centre offset for L2
d) Vertical offset
e) **Vertical Height Reading**

Vertical offset = 0.36

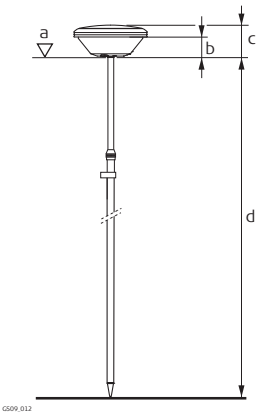
Determining the antenna height with the height hook step-by-step

Step	Description
1.	The vertical height reading = vertical height reading from the height hook. • The vertical height reading is the height difference between the ground mark and the bottom end of the height hook. • The vertical offset of 0.36 m is automatically stored in the antenna setup record for a tripod setup and will automatically be taken into account. It does not need to be entered.

3.5 Measuring the Antenna Height for a Pole Setup

Measuring the antenna height, a quick overview

Setup Type	Antenna type	The required measurement
Pole	GS09 Pole	the vertical height reading of the pole.



a) Mechanical reference plane MRP
b) Vertical phase centre offset for L1
c) Vertical phase centre offset for L2
d) **Vertical Height Reading**. 2.00 m for the fully extended Leica telescopic pole.

Vertical offset = 0.00

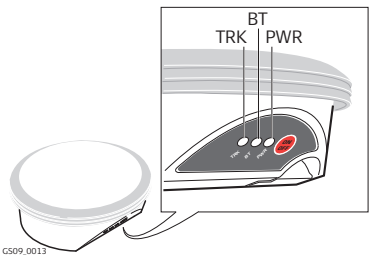
3.6 The LED Indicators on the GS09 Antenna

LED indicators

Description

GS09 antenna has **L**ight **E**mitting **D**iode indicators. They indicate the basic antenna status.

Diagram of the LED indicators



TRK	Tracking LED
BT	Bluetooth LED
PWR	Power LED

Description of the LED indicators

IF the	is	THEN
TRK	off	No satellites are tracked.
	flashing green	Less than four satellites are tracked, a position is not yet available.
	green	Enough satellites are tracked to compute a position.
	red	GS09 antenna is initialising.
BT	green	Bluetooth is in data mode and ready for connecting.
	purple	Bluetooth is connecting.
	blue	Bluetooth has connected.
	flashing blue	Data is being transferred
PWR	off	Power is off.
	green	Power is okay.
	flashing green	Power is low. The remaining time for which enough power is available depends on the type of survey, the temperature and the age of the battery.

4 Turning On / Turning Off

4.1 Turning On/Off, Switching to Desktop

Turning on CS09 field controller

- Press and hold **PROG** (ON) for 2 s. (CS09 field controller must have a power supply).

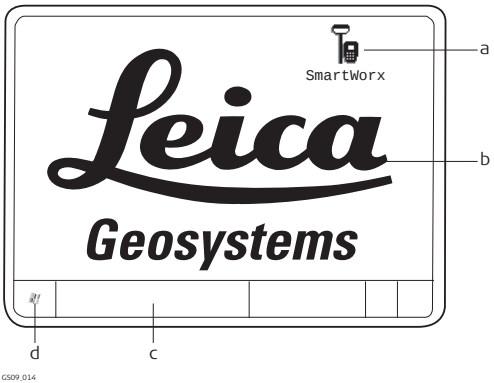
Turning off CS09 field controller

- CS09 field controller can only be turned off in the Main Menu screen.
  - Press the **USER** and **PROG** keys simultaneously, or
  - Hold **ESC** for 2 s.

Putting CS09 field controller into sleep mode

- In sleep mode, CS09 field controller shuts down and reduces power consumption. Rebooting from sleep mode is quicker than a cold start after turning off.
- CS09 field controller can only be put into sleep mode in the Main Menu screen.
- Press **SHIFT SLEEP (F3)** to put CS09 field controller into sleep mode.

Switching between Leica SmartWorx software and the Windows CE desktop



a) Icon to start Leica SmartWorx software
b) Windows CE desktop
c) Task bar
d) Windows CE start button

Accessing the Main Menu screen

IF	THEN
CS09 field controller is started	• the Leica SmartWorx software starts up automatically.

IF	THEN
Windows CE desktop is active	• double click to display the Leica SmartWorx software, or • press **SHIFT PROG** ( ) to display the Leica SmartWorx software.
Leica SmartWorx software is minimised	• double click to maximise it, or • select GS09 antenna in the task bar to maximise it.

Accessing the Windows CE desktop

IF	THEN
Leica SmartWorx software is to be minimised	**SHIFT MINIM (F5)** in the Main Menu screen.
Leica SmartWorx software is to be closed	**SHIFT EXIT (F6)** in the Main Menu screen.
Windows CE task bar is to be displayed	**SHIFT PROG** ( ).

4.2 Operating by Keyboard or Touch Screen

Operating with the keyboard and the touch screen

The user interface is operated either by the keyboard or by the touch screen, with supplied stylus. The workflow is the same for keyboard and touch screen entry, the only difference lies in the way information is selected and entered.

Operation by keyboard
Information is selected and entered using the keys. Refer to "2.1 The Keyboard" for a detailed description of the keys on the keyboard and their function.

Operation by touch screen
Information is selected and entered on the screen using the supplied stylus.

Operation	Description
To select an item	Tap on the item.
To start the edit mode in input fields	Tap on the input field.
To highlight an item or parts of it for editing	Drag the supplied stylus from the left to the right.
To accept data entered into an input field and exit the edit mode	Tap on the screen outside of the input field.

5 Understanding the Main Menu

Description

The Main Menu is the first screen displayed when the instrument is switched on.

The Main Menu screen

CONT (F1)
To select the highlighted option and to continue with the subsequent screen.

SHIFT OFF (F2)
To completely turn CS09 field controller off.

SHIFT SLEEP (F3)
To put CS09 field controller into sleep mode.

SHIFT MINIM (F5)
To minimise Leica SmartWorx software.

SHIFT EXIT (F6)
To close Leica SmartWorx software.

Description of the Main Menu functions

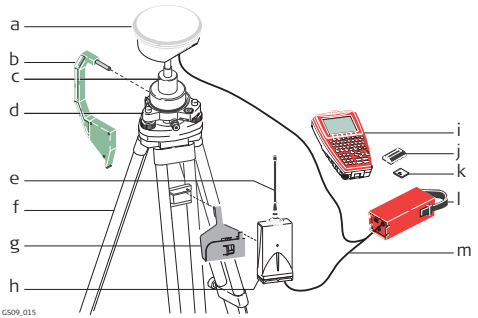
Main menu function	Short description of functions
Survey	• To start survey.
Programs...	• To select and start programs.
Manage...	• To manage jobs and their data, codelists and coordinate systems.
Convert...	• To export data from a job in a customised ASCII, DXF or LandXML format. • To import ASCII, GSI or DXF data to a job on CS09 field controller. • To copy points between jobs.
Config...	• To access all configuration parameters related to a survey, CS09 field controller and the GFU device such as radio.
Tools...	• To format the memory. • To transfer files between CS09 field controller and CF card.

Main menu function	Short description of functions
	• To upload firmware and language files. • To access a calculator. • To view files in the CF card. • To manually type in or upload a licence key. • To perform arithmetic operations such as addition, subtraction, multiplication, division, statistical functions, trigonometric functions, conversions or roots.

6 Setting Up and Starting Up

6.1 Setting Up as a Real-Time Reference

Diagram showing real-time reference setup



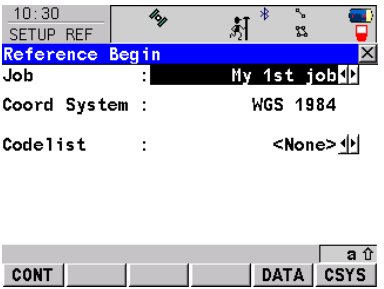
a) GS09 antenna
b) Height hook
c) GRT146 carrier*
d) Tribrach
e) Antenna for device
f) Tripod
g) GHT58 tripod bracket
h) GFU radio modem
i) CS09 field controller
j) GEB211 / GEB212 battery for CS09 field controller
k) CompactFlash card
l) GEB171 external battery
m) GEV205 Y-cable

* The GRT146 carrier has a screw fitting. GS09 antenna fits directly onto this fitting.

Setup and Startup for real-time reference step-by-step

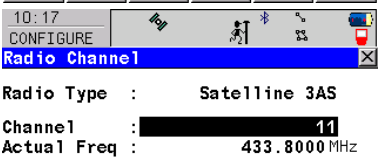
Step	Description
1.	**Setting Up the Equipment**
	• Set up the tripod, mount and level the tribrach onto the tripod.
	• Check that the tribrach is correctly centred over the marker.
	• Place and lock the carrier into the tribrach.
	• Screw GS09 antenna onto the carrier.
	• Check that the tribrach is still correctly positioned and levelled.
	• Hang the external battery onto a tripod leg.
	• Hang the tripod bracket onto a tripod leg and attach the radio housing onto the tripod bracket. Make sure that the radio antenna is screwed onto the radio housing.
	• Take the GEV205 Y-cable.
	• Attach the connector with the 8 pin plug to GS09 antenna.
	• Attach the connector with the 5 pin plug to the external battery.
	• Attach the connector without pins to the radio housing.
	• Insert the CompactFlash card into CS09 field controller.
	• Insert the battery into CS09 field controller and turn on CS09 field controller and GS09 antenna.

Step	Description
2.	**Starting Up with the Setup Reference Program**



2.a Selecting the Job

- Select a Job.
- Press **DATA (F5)** to check all of the points in the selected job.
- Press **CONT (F1)** to continue.

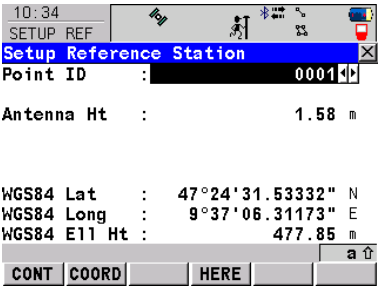


2.b Selecting the Antenna

- Select the antenna.*
  For a pillar setup, select GS09 Pillar. For a tripod setup, select GS09 Tripod.
- Press **SRCH (F4)** to start searching for the antenna, via Bluetooth.
- Press **CONT (F1)** to continue.

2.c Setting the Radio Channel**

- Enter the radio channel. It is important to remember that the radio at the reference and the radio at the rover must be set to the same frequency.
  Press **SCAN (F5)** to scan for the radio at the reference.
- Press **CONT (F1)** to continue.



2.d Selecting the Reference Point

- Select the known point.***
- Enter the antenna height.
  For a pillar setup, this will be the vertical height reading to the MRP. For a tripod setup, this will be the vertical height reading from the height hook.
- Press **HERE (F4)** to use the current navigated position for the setup.
- Press **CONT (F1)** to continue.

2.e Completing the Setup

- Press **FNSH (F1)** to continue and return to the Main Menu screen.

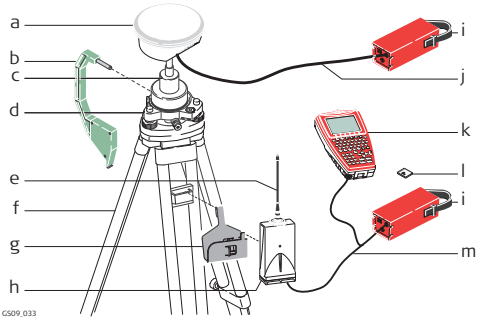
* Refer to "3 Using the GS09 Antenna" for further information on antennas and antenna heights.

** Depending on the radio attached the screen content slightly differs.

*** When setting the reference point for the setup, the selected point must be able to be viewed as WGS1984 coordinates.

6.2 Setting Up Real-Time Reference with Raw Data Logging

Diagram showing real-time reference setup with raw data logging



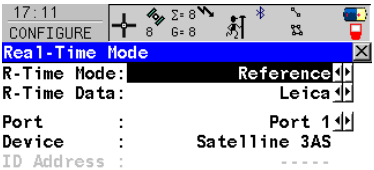
a) GS09 antenna
b) Height hook
c) GRT146 carrier*
d) Tribrach
e) Antenna for device
f) Tripod
g) GHT58 tripod bracket
h) GFU radio modem
i) GEB171 external battery
j) GEV219 cable
k) CS09 field controller
l) CompactFlash card
m) GEV205 Y-cable

* The GRT146 carrier has a screw fitting. GS09 antenna fits directly onto this fitting.

Setup and Startup for real-time reference with raw data logging step-by-step

Step	Description
1.	**Setting Up the Equipment**
	• Set up the tripod, mount and level the tribrach onto the tripod.
	• Check that the tribrach is correctly centred over the marker.
	• Place and lock the carrier into the tribrach.
	• Screw GS09 antenna onto the carrier.
	• Check that the tribrach is still correctly positioned and levelled.
	• Hang the external batteries onto the tripod legs.
	• Hang the tripod bracket onto a tripod leg and attach the radio housing onto the tripod bracket. Make sure that the radio antenna is screwed onto the radio housing.
	• Insert the CompactFlash card into CS09 field controller.
	• Take the GEV205 Y-cable.
	• Attach the connector with the 8 pin plug to CS09 field controller.
	• Attach the connector with the 5 pin plug to the external battery.
	• Attach the connector without pins to the radio housing.
	• Take the GEV219 cable.

Step	Description
	• Attach the connector with the 8 pin plug to GS09 antenna.
	• Attach the connector with the 5 pin plug to the external battery.
	• Turn on CS09 field controller and GS09 antenna.
2.	**Configuring the Raw Data Logging**
	• Select **Main Menu**: , ,
	• Determine during what circumstances raw observations are logged.
	• Determine the rate at which raw observations are logged.
3.	**Configuring the Real-Time Reference Mode**
	• Select **Main Menu**: ,
	• Select a Config Set and press **CONT (F1)** to continue.
	• Highlight the Real-Time interface and press **EDIT (F3)** to edit the Real-Time mode.

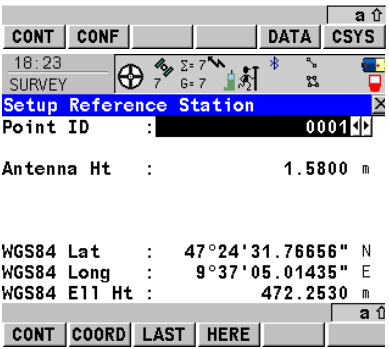


- Set the R-Time Mode to Reference.
- Press **DEVCE (F5)** to select the radio.
- Press **CONT (F1)** to continue and then press **CONT (F1)** again to return to the Main Menu screen.

Step	Description
4.	**Starting Up with the Survey Program**

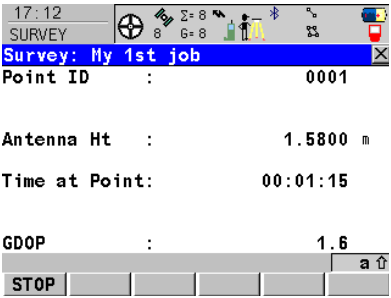
4.a Selecting the Job

- Select the Job Default.
- Select the WGS1984 coord system.
- Press **CONT (F1)** to continue.



4.b Selecting the Reference Point

- Select the known point.*
- Enter the antenna height.
  For a pillar setup, this will be the vertical height reading to the MRP. For a tripod setup, this will be the vertical height reading from the height hook.
- Press **HERE (F4)** to use the current navigated position for the setup.
- Press **CONT (F1)** to continue.



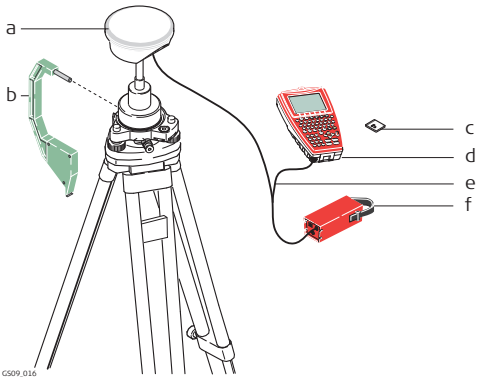
4.c Surveying the Point

- Press **STOP (F1)** when enough data is collected for the point. The point is stored and the Main Menu screen appears.

* When setting the reference point for the setup, the selected point must be able to be viewed as WGS1984 coordinates.

6.3 Setting Up for Raw Data Logging

Diagram showing setup for raw data logging

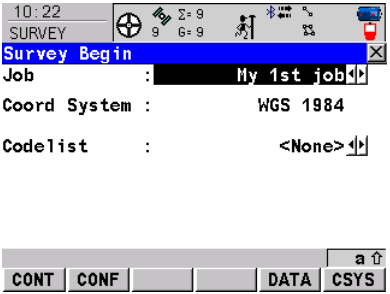


a) GS09 antenna
b) Height hook
c) CompactFlash card
d) CS09 field controller
e) GEV215 Y-cable
f) GEB171 external battery

Setup and Startup for raw data logging step-by-step

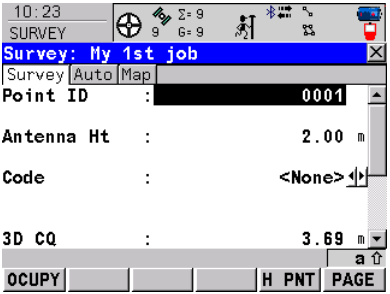
Step	Description
1.	**Setting Up the Equipment**
	• Set up the tripod, mount and level the tribrach onto the tripod.
	• Check that the tribrach is correctly centred over the marker.
	• Place and lock the carrier into the tribrach.
	• Screw GS09 antenna onto the carrier.
	• Check that the tribrach is still correctly positioned and levelled.
	• Hang the external battery onto a tripod leg.
	• Take the GEV205 Y-cable.
	• Attach the connectors with the 8 pin plug to GS09 antenna and to CS09 field controller.
	• Attach the connector with the 5 pin plug to the external battery (internal batteries can also be used for powering GS09 antenna/CS09 field controller).
	• Turn on GS09 antenna and CS09 field controller.
2.	**Configuring the Raw Data Logging**
	• Select **Main Menu**: , ,

Step	Description
	• Determine during what circumstances raw observations are logged (**Static Only** or **Static & Moving**).
	• Determine the rate at which raw observations are logged.
3.	**Starting Up with the Survey Program**



3.a Selecting the Job

- Select the Job Default.
- Select the WGS1984 coord system.
- Press **CONT (F1)** to continue.



3.b Surveying the Point

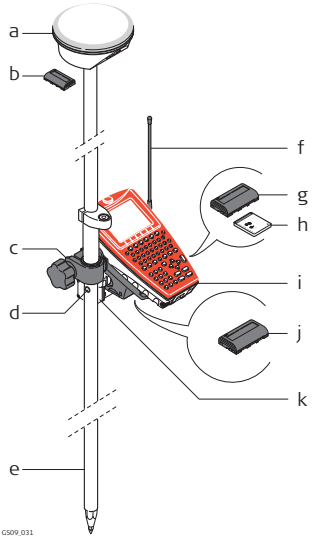
- Enter the point ID.
- Enter the antenna height.
  For a tripod setup, this will be the vertical height reading from the height hook.
- Press **OCUPY (F1)** to start measuring the point.*,**
  Press **STOP (F1)** when enough data is collected for the point.
  Press **STORE (F1)** to store the point.
- Continue to press **ESC** until the Main Menu screen appears.

* As the point is being measured, the position mode icon changes from the moving icon to the static icon.

****SHIFT QUIT (F6)** always terminates the survey operation. In this case all data collected since pressing **OCUPY (F1)** is lost.

6.4 Setting Up as a Real-Time Rover

Diagram showing real-time rover setup

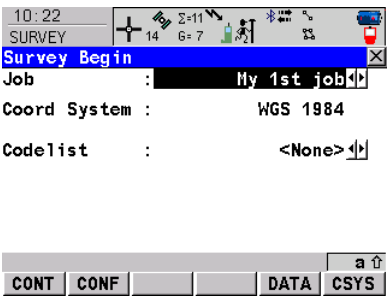


a) GS09 antenna
b) GEB211 / GEB212 battery
c) GHT63 pole clamp
d) Snap-lock of the pole
e) GLS30 telescopic pole
f) Radio antenna
g) GEB211 / GEB212 battery
h) CompactFlash card
i) CS09 field controller
j) GEB211 / GEB212 battery
k) GFU radio or GSM modem

Setup and Startup for real-time rover step-by-step

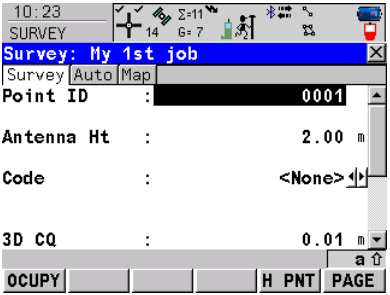
Step	Description
1.	**Setting Up the Equipment**
	• Insert the battery into GS09 antenna.
	• Screw GS09 antenna onto the top of the telescopic pole.
	• Ensure that the compression lock is not clamped.
	• Fully extend the telescopic pole and ensure that the snap-lock clicks into its position. The snap-lock ensures that there is no slipping of the telescopic pole.
	• Clamp the compression lock. The compression lock maintains straightness.
	• Remove the plastic sleeve from the clamp (if using a carbon-fibre pole). Slide the clamp onto the bottom part of the telescopic pole.
	• Fix the holder to the clamp with the tightening screw. Before tightening, ensure that the holder is at a comfortable working height and angle. This can be achieved by sliding the clamp along the pole and rotating the holder about the clamp. Tighten the tightening screw.
	• Insert the CompactFlash card into CS09 field controller.
	• Insert the battery into CS09 field controller and GHT56 holder.

Step	Description
	• Clip GFU modem to the GHT56 holder. Refer to "6.11 Working with the Clip-On-Housings for Devices on GHT56" for further information.
	• Clip CS09 field controller onto the holder and lock into position. Refer to "Attaching CS09 field controller to the GHT56 holder step-by-step" for further information.
	• Turn on GS09 antenna and CS09 field controller.
2.	**Starting Up with the Survey Program**



2.a Selecting the Job

- Select the Job Default.
- Select the WGS1984 coord system.
- Press **CONT (F1)** to continue.



2.b Surveying the Point

- Move to the point, enter the point ID.
- Enter the antenna height.
  For Leica standard poles = 2.00 m.
- Press **OCUPY (F1)** to start measuring the point.*,**,***
  Press **STOP (F1)** when enough data is collected for the point.
  Press **STORE (F1)** to store the point.
- Are more points to be surveyed?
  If yes, repeat the first three points.
  If no, continue with the next point.
- Continue to press **ESC** until the Main Menu screen appears.

* Before the point is measured, the position mode icon is the moving icon, indicating that the rover can still be moved around.

** As the point is being measured, the position mode icon changes to the static icon, indicating that the rover should remain stationary.

***__SHIFT QUIT (F6)__ always terminates the survey operation. In this case all data collected since pressing **OCUPY (F1)** is lost.

6.5 Connecting to the GS09 Antenna with Bluetooth

Communicating via Bluetooth step-by-step

Step	Description
1.	Select **Main Menu**: , ,
2.	Select **Comm: Bluetooth**.
3.	Press **SRCH (F4)** to search for Bluetooth devices. The GS09 antenna must be turned on.
4.	The **CONFIGURE Search Bluetooth Device** screen appears. All available Bluetooth devices are displayed.
5.	Highlight and select the antenna to be used.
6.	Press **CONT (F1)**. Press **CONT (F1)** to return to the Main Menu screen.
☞	If the antenna selected is connected for the first time, a Windows CE authentication request comes up. Type in 0000 as identification number for Leica's Bluetooth and click **OK**.
☞	Once the Bluetooth connection is established, the Bluetooth LED on the antenna starts flashing in blue.

6.6 Connecting to a Digital Cellular Phone

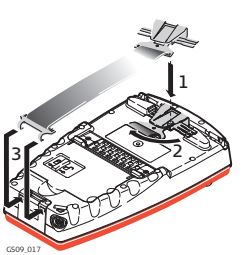
Connecting step-by-step

Step	Description
1.	Select **Main Menu**: ,
2.	Highlight **Real-Time**.
3.	**EDIT (F3)**
4.	**CONFIGURE Real-Time Mode** **<R-Time Mode: Rover>** Select a free Bluetooth port.
5.	**DEVCE (F5)**
6.	**CONFIGURE Devices** Highlight a Bluetooth capable digital cellular phone.
7.	**CONT (F1)**
8.	**SRCH (F4)** to search for the digital cellular phone. The digital cellular phone must be turned on and Bluetooth must be activated.

Step	Description
9.	**CONFIGURE Search Bluetooth Device** All available Bluetooth devices are displayed.
10.	Highlight the digital cellular phone to be used.
11.	**CONT (F1)** ☞ If the digital cellular phone selected is connected for the first time, the Windows CE dialog for pairing comes up. Type in 0000 as identification number for Leica's Bluetooth and click **OK**. ☞ Some digital cellular phones also ask for the identification number for Leica's Bluetooth. The number is 0000. ☞ Some digital cellular phones also ask for an acknowledgement before connecting to another Bluetooth device.

6.7 Fixing a Hand Strap to the CS

Fixing the GHT41 Handstrap to the CS09 field controller step-by-step

Step	Description	
1.	Hold the main hook rotated to approximately the 11 o'clock position in relation to CS09 field controller.	
2.	Lower the main hook onto the pivot knob in the middle of CS09 field controller.	
3.	Rotate the main hook to the 12 o'clock position. A click should be felt when the clip is secure.	
4.	Take the other end of the handstrap and clip it to the base of CS09 field controller.	

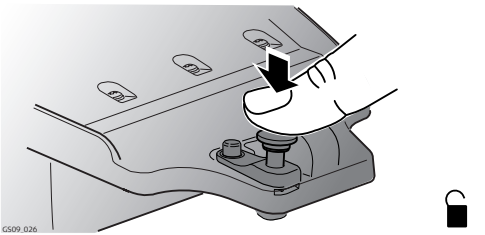
6.8 Fixing the CS to a Holder and Pole

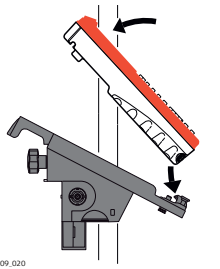
Attaching the GHT56 holder to the left or right side of the pole

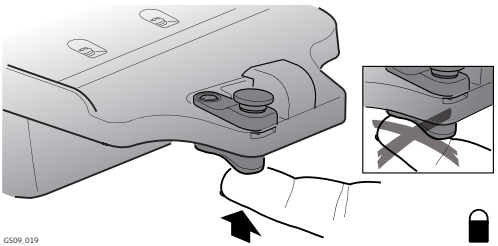
The GHT56 holder can be attached either to the left side or right side of the pole.

Step	Description
	Refer to "1.4 Components of the GHT56 Holder and GHT63 Clamp" for further information on the holder.
1.	Remove the thumb screw from the mounting plate.
2.	Remove the mounting arm from the mounting plate and re-position it.
3.	Re-fix the mounting arm to the mounting plate with the tightening screw.

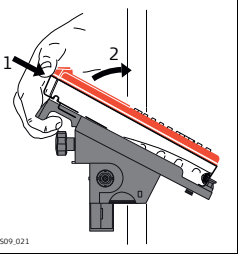
Attaching CS09 field controller to the GHT56 holder step-by-step

Step	Description
☞	A locking mechanism is incorporated in the mounting plate of the holder.
1.	Before CS09 field controller is placed onto the mounting plate ensure that the locking pin is put into the unlocked position. To unlock the locking pin, push down the red button situated on top of the mounting plate. 
2.	Hold CS09 field controller above the holder and lower the end into the holder.

Step	Description
3.	Apply slight pressure in a downward direction and then lower the top part of CS09 field controller until the unit is clicked into the holder. The guides of the holder aid in this action.  GS09_020

Step	Description
4.	After CS09 field controller is placed onto the mounting plate ensure that the locking pin is put into the locked position. To lock the locking pin, push up the red button from below.  GS09_019

Detaching CS09 field controller from the GHT56 holder step-by-step

Step	Description
1.	Unlock the locking pin by pushing down the red button situated on top of the mounting plate.
2.	Place the palm over the top of CS09 field controller until the fingers grip the bar of the holder under CS09 field controller.
3.	Push the top of CS09 field controller toward the bar of the holder.
4.	While in this position, raise the top of CS09 field controller from the holder. 

6.9 Batteries

6.9.1 Operating Principles

Charging / first-time use

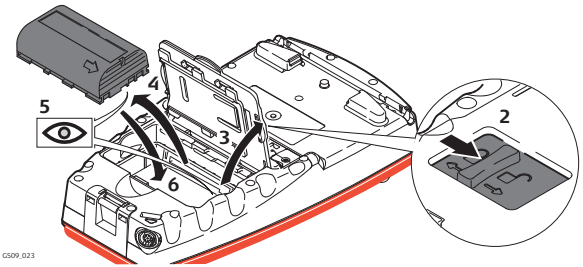
- The battery must be charged prior to using it for the first time because it is delivered with an energy content as low as possible.
- The permissible temperature range for charging is between 0°C to +40°C/ +32°F to +104°F. For optimal charging, we recommend charging the batteries at a low ambient temperature of +10°C to +20°C/+50°F to +68°F if possible.
- It is normal for the battery to become warm during charging. Using the chargers recommended by Leica Geosystems, it is not possible to charge the battery if the temperature is too high.
- For new batteries or batteries that have been stored for a long time (> three months), it is effectual to make only one charge/discharge cycle.
- For Li-Ion batteries, a single discharging and charging cycle is sufficient. We recommend carrying out the process when the battery capacity indicated on the charger or on a Leica Geosystems product deviates significantly from the actual battery capacity available.

Operation / Discharging

- The batteries can be operated from -20°C to +55°C/-4°F to +131°F.
- Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery.

6.9.2 Changing the Battery on the CS09 Field Controller

Changing the battery on CS09 field controller step-by-step

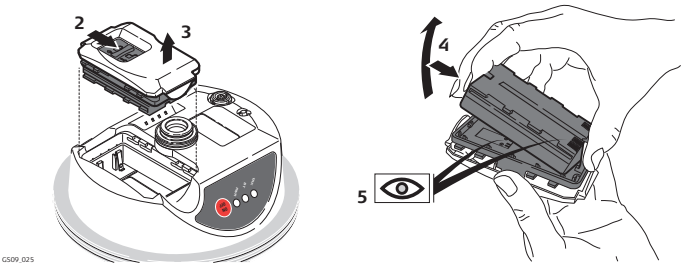


Step	Description
1.	Turn CS09 field controller over to gain access to the battery compartment.
2.	Push the slide fastener in the direction of the arrow with the open-lock symbol.
3.	Open the battery compartment.
4.	Pull the battery from the battery compartment.
5.	A polarity of the battery is displayed inside the battery compartment. This is a visual aid to assist in placing the battery correctly.

Step	Description
6.	Place the battery into the battery compartment, ensuring that the engraved arrow symbol is pointing toward the battery contacts.
7.	Close the battery compartment by pushing the slide fastener in the direction of the arrow with the close-lock symbol.

6.9.3 Changing the Battery on the GS09 Antenna

Changing the battery on GS09 antenna step-by-step

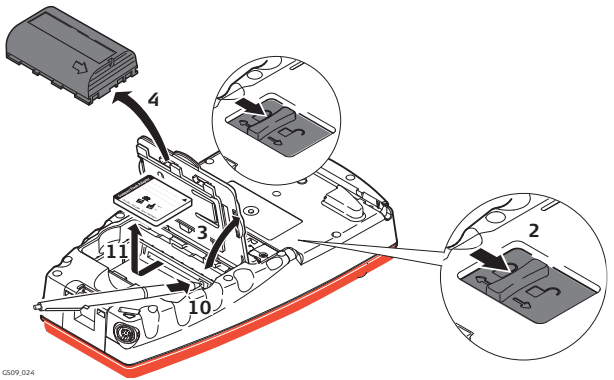


Step	Description
1.	Turn GS09 antenna over to gain access to the battery compartment.
2.	Open the battery compartment by pushing the slide fastener in the direction of the arrow with the open-lock symbol.
3.	Pull out the battery housing. The battery is attached to the housing.
4.	Hold the battery housing and pull the battery from the battery housing.

Step	Description
5.	A polarity of the battery is displayed inside the battery housing. This is a visual aid to assist in placing the battery correctly.
6.	Place the battery onto the battery housing, ensuring that the contacts are facing outward. Click the battery into position.
7.	Close the battery compartment by pushing the slide fastener in the direction of the arrow with the close-lock symbol.

6.10 Changing the CompactFlash card on the CS09 Field Controller

Changing the CompactFlash card on CS09 field controller step-by-step



Step	Description
☞	The CompactFlash card is inserted into a slot inside the battery compartment.

Step	Description
1.	Turn CS09 field controller over to gain access to the battery compartment.
2.	Push the slide fastener in the direction of the arrow with the open-lock symbol.
3.	Open the battery compartment.
4.	Pull the battery from the battery compartment.
5.	The card should be held with the label for the care instructions upwards and the contacts facing the slot. Slide the card firmly into the slot until it clicks into position.
6.	Place the battery into the battery compartment, ensuring that the engraved arrow symbol is pointing toward the battery contacts.
7.	Close the battery compartment by pushing the slide fastener in the direction of the arrow with the close-lock symbol.
8.	To remove the card, open the cover of the battery compartment.
9.	Pull the battery from the battery compartment.
10.	Press the eject button on the right side of the card slot twice.
11.	Pull out the CompactFlash card and close the compartment cover.

6.11 Working with the Clip-On-Housings for Devices on GHT56

Devices fitting into a clip-on-housing

Digital cellular phones fitting into a clip-on-housing

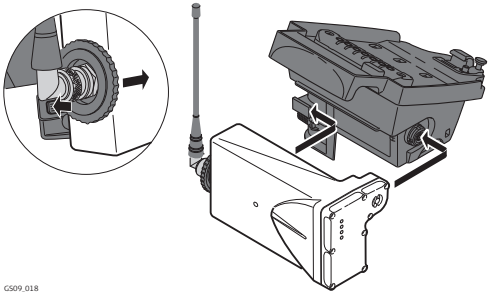
Digital cellular phone	Clip-on-housing
Siemens MC75	GFU24
CDMA MultiTech MTMMC-C (US)	GFU19
CDMA MultiTech MTMMC-C (CAN)	GFU25
Telit UC864-G	GFU28

Radios fitting into a clip-on-housing

Radio	Clip-on-housing
Pacific Crest PDL, receive	GFU15
Satelline 3AS, transceive	GFU14
Satelline M3-TR1, transceive	GFU27

Attach a clip-on-housing step-by-step

The clip-on-housing for devices fits to the underside of the GHT56.



Step	Description
1.	A circular screw is located at one end of the clip-on-housing. Ensure that the circular screw is in the unlocked position. Turn it anticlockwise, as shown by the lock and arrow symbols on the screw.
	Turn GHT56 over to gain access to the space for the clip-on-housing.

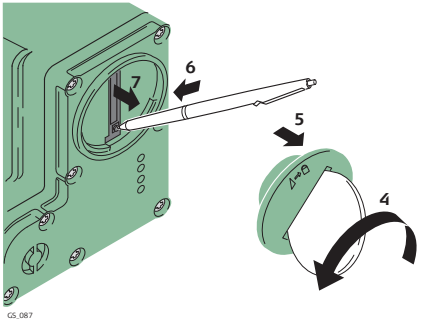
Step	Description
2.	Place the clip-on-housing into position such that • the guide rails on the GHT56 are aligned with the guide rails on the clip-on-housing. AND • the LEMO port on the GHT56 is aligned with the connector on the clip-on-housing.
3.	Slide the clip-on-housing into position such that the connector is completely plugged into the LEMO port. It clicks. ☞ Do not turn the screw on the topside of the clip-on-housing. The clip-on-housing is automatically fixed when completely plugged into position.

Detach a clip-on-housing step-by-step

Step	Description
1.	Press the small press clip next to the guide rail on the GHT56 to unlock the clip-on-housing from the GHT56.
2.	Slide the clip-on-housing away from the press clip until the connector is completely unplugged from the LEMO port.
3.	Pull the clip-on-housing from the GHT56.

Insert a SIM card step-by-step

For those digital cellular phones that require SIM cards.



Step	Description
1.	Take the SIM card, a coin and a pen.
2.	Locate the SIM card screw, that covers the SIM card slot, on the bottom of the clip-on-housing.
3.	Insert the coin into the groove of the SIM card screw.
4.	Turn the coin anticlockwise to loosen the SIM card screw.
5.	Remove the SIM card screw from the housing.

Step	Description
6.	Using the pen, press the small button of the SIM card slot to eject the SIM card holder.
7.	Take the SIM card holder out off the housing.
8.	Put the SIM card into the SIM card holder, the chip facing up.
9.	Insert the SIM card holder into the SIM card slot, the chip facing the connectors inside the slot.
10.	Place the SIM card screw back on the housing.
11.	Insert the coin into the groove of the SIM card screw.
12.	Turn the coin clockwise to tighten the SIM card screw.

Remove a SIM card step-by-step

For those digital cellular phones that require SIM cards.

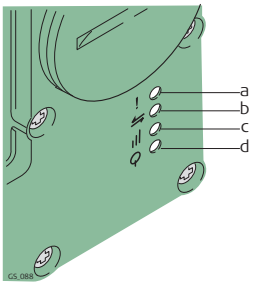
Step	Description
1.	Take a coin and a pen.
2.	Locate the SIM card screw, that covers the SIM card slot, on the bottom of the clip-on-housing.
3.	Insert the coin into the groove of the SIM card screw.
4.	Turn the coin anticlockwise to loosen the SIM card screw.
5.	Remove the SIM card screw from the housing.
6.	Using the pen, press the small button of the SIM card slot to eject the SIM card holder.
7.	Take the SIM card holder out off the SIM card slot.
8.	Take the SIM card out of the SIM card holder.
9.	Put the SIM card holder back into the SIM card slot, the even side not facing the contacts inside the slot.
10.	Place the SIM card screw back on the housing.
11.	Turn the coin clockwise to tighten the SIM card screw.

LED indicators

Description

Each clip-on-housing for a radio or digital cellular phones has **L**ight **E**mitting **D**iode indicators on the bottom side. They indicate the basic device status.

Diagram



a) Mode LED, available for Satelline 3AS
b) Data transfer LED
c) Signal strength LED
d) Power LED

Description of the LEDs

IF the	on	is	THEN
Mode LED	GFU14 with Satelline 3AS, GFU27 with Satelline M3-TR1	red	the device is in the programming mode controlled from the PC via cable.
Data transfer LED	any device	off	data is not being transferred.
		green or flashing green	data is being transferred.
Signal strength LED	GFU19 (US), GFU25 (CAN) with CDMA Multi-Tech MTMMC-C	red	device is on, not registered on the network.
		flashing red	device is on, registered on the network.
		off	download mode or device is off.

IF the	on	is	THEN
	GFU24 with Siemens MC75, GFU28 with Telit UC864-G	red	call is in progress.
		red: long flash, long break	no SIM card inserted, no PIN entered or network search, user authentication or network login in progress.
		red: short flash, long break	logged on to network, no call in progress.
		red: flashing red, long break	GPRS PDP context activated.
		red: long flash, short break	Packet switched data transfer is in progress.
		off	device is off.
	GFU15 with Pacific Crest PDL	red or flashing red	the communication link, **D**ata **C**arrier **D**etection, is okay on the roving instrument.
		off	the DCD is not okay.

IF the	on	is	THEN
	GFU14 with Satelline 3AS, GFU27 with Satelline M3-TR1	red or flashing red	the communication link, **D**ata **C**arrier **D**etection, is okay on the roving instrument.
		off	the DCD is not okay.
Power LED	any device	off	power is off.
		green	power is okay.

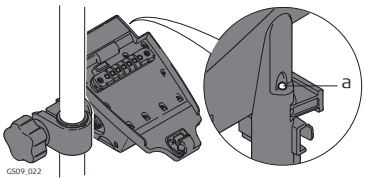
6.12 LED Indicators on GHT56

LED indicator

Description

GHT56 has one **L**ight **E**mitting **D**iode indicator. It indicates the basic power status.

Diagram



a) Power LED

Description of the LED

IF the	is	THEN
PWR	off	power is off.
	green	power is okay.
	flashing green	power is low. The remaining time for which enough power is available depends on the type of survey, the temperature and the age of the battery.
	red	power is very low. The battery should be changed.

6.13 Using Licence Keys

Description

A licence key can be used to activate protected programs and protected instrument options and can be used to define the expiry date of the software maintenance.

Protected programs

A licence key is required for the following protected programs:

Protected programs
• COGO Area Division
• DTM Stakeout
• Reference Line
• RoadRunner
• Volume Calculations

Protected instrument options

A licence key is required for the following protected instrument options:

Protected instrument options
• 5 Hz update rate • 5 km RTK range • Unlimited RTK range • GLONASS tracking • RTK network access • Bluetooth functionality • Raw data logging • RTCM/CMR data input • NMEA Output

Access

- From **Main Menu**: , , or
- Select a program on CS09 field controller which is not yet activated.

Entering/Loading a licence key

- A licence key file can be uploaded to CS09 field controller. To upload a licence key file the file should be located on the \SYSTEM directory of the CompactFlash card. Licence key files use the naming convention L_123456.key, where 123456 is the instrument serial number.
- Licence keys can also be typed in manually.

CONT (F1)
To accept changes and return to the Main Menu screen or continue with the program.

SHIFT DEL (F4)
To delete all licence keys on CS09 field controller.

Field	Description of Field
Method	• The method used to input the licence key to activate the program or the protected options or the software maintenance. • **Upload Key File**. The licence key file is uploaded from the CompactFlash card. The licence key file must be stored in the \SYSTEM directory in the CompactFlash card. • **Manual Entry of Key**. Allows the licence key to be typed in manually.

Field	Description of Field
Key	• Available for ‹Method: Manual Entry of Key›. The licence key required to activate a program. Entry is not case sensitive.

The next step

IF a licence key is to be	THEN
uploaded	select the method used to input the licence key and press **CONT (F1)**.
deleted	press **SHIFT DEL (F4)**. All entered licence keys will be deleted.

6.14 Checking and Adjusting the Circular Level of the Tribrach

Description

- The adjustable circular level on the tribrach is used to level the GS09 antenna over the observation point. An incorrectly adjusted circular level means that the GS09 antenna is not properly positioned over the point, which means that another point on the ground is observed.
- The tribrach should be checked and adjusted:
  - at regular periods,
  - before the first use,
  - after long periods of transport,
  - after long periods of work,
  - if the temperature changes by more than 20°C.

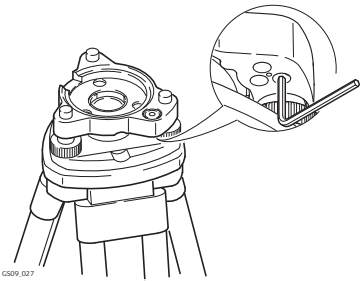
Equipment check-list

The required equipment for the checking and adjusting of the circular level are:

- Tripod,
- Tribrach,
- A carrier, with a precision bubble checked and adjusted or a TPS instrument,
- Bubble adjusting key.

Checking and adjusting the circular level step-by-step

Step	Description
1.	Set up the tripod.
2.	Screw the tribrach onto the tripod.
3.	Fix the carrier/instrument onto the tribrach.
4.	Level the tribrach using the precision bubble on the carrier or the precision bubble on the instrument.
5.	Is the circular level on the tribrach centered and not extended beyond the inscribed circle? • If **yes**, no adjustment is required. The procedure is finished. • If **no**, the bubble requires adjusting. Continue with step 6.
6.	Remove the carrier/instrument.

Step	Description
7.	Centre the circular level using the adjustment pin in conjunction with the adjustment screws on the underside of the casing of the circular level. 
8.	Fix the carrier/instrument onto the tribrach.
9.	Repeat steps *4.* to 5.

6.15 Checking and Adjusting the Circular Bubble of the Pole

Checking and adjusting the circular bubble

It is important that the adjustable circular bubble of the pole is kept in adjustment. Whenever the Leica GS09 equipment is sent for servicing to a Leica Geosystems authorised service workshop, it is recommended that the pole is also sent for servicing.

6.16 Guidelines for Correct Results with GNSS Surveys

Undisturbed satellite signal reception	Successful GNSS surveys require undisturbed satellite signal reception, especially at the instrument which serves as a base. Set up the instrument in locations which are free of obstructions such as trees, buildings or mountains.
Steady antenna for static surveys	For static surveys, the antenna must be kept perfectly steady throughout the whole occupation of a point. Place the antenna on a tripod or pillar.
Centred and levelled antenna	Centre and level the antenna precisely over the marker.

7 Connecting to a Personal Computer

Microsoft ActiveSync (for PCs with Windows XP operating system) or Windows Mobile Device Center (for PCs with Windows Vista or Windows 7 operating system) is the synchronisation software for Windows mobile-based pocket PCs. Microsoft Active-Sync or Windows Mobile Device Center enables a PC and a Windows mobile-based pocket PC to communicate.

Installing the USB Driver using the USB cable step-by-step

Step	Description
	This procedure is only required when connecting for the first time.
1.	Start the office computer.
2.	Turn on CS09 field controller by pressing and holding **PROG** (ON) for 2 s.
3.	Connect the USB cable to CS09 field controller and to the office computer.
4.	**Installing the USB driver**
	• The **Found New Hardware Wizard** appears on the office computer. Select the **No** option (Windows Updates), click **Next** to continue.
	• Select **Install from a list or specific location**, click **Next** to continue.
	• Insert the Leica GS09 CD ROM, which contains the necessary USB driver.

Step	Description
	• Select **Search removable media**, click **Next** to continue.
	• The system will search and install the USB driver from the CD ROM. A confirmation window may appear, click **Continue Anyway**.
	• Click **Finish** to complete the process.

Connecting to a PC using the USB cable step-by-step

Step	Description
1.	Turn on CS09 field controller by pressing and holding **PROG** (ON) for 2 s.
2.	Connect the USB cable to CS09 field controller.
3.	Connect the USB cable to a USB port on the office computer.
4.	For PCs with Windows XP operating system:
	Run the ActiveSync installation program if not already installed.
	Allow USB connections inside the **Connection Settings** window of Active-Sync.
5.	For PCs with Windows Vista or Windows 7 operating system:
	Windows Mobile Device Center starts up automatically. If it does not start automatically, start Windows Mobile Device Center.

Step	Description
6.	When the USB connection is established, data files can be transferred between CS09 field controller and the office computer.

Ensure that CS09 field controller has been configured to connect to the computer with USB cable. The settings can be checked from **Start/Settings/Control Panel/PC Connection**.

Connecting to a PC (LEICA Geo Office) using the USB cable step-by-step

Step	Description
1.	**Setting up the CS09 field controller**
	• Plug the USB cable into the LEMO port of the CS09 field controller.
	• Turn on CS09 field controller by pressing and holding **PROG** (ON) for 2 s.
	• Plug the USB cable into a USB port on the office computer.
2.	**Setting up synchronisation software**
	For PCs with Windows XP operating system:
	• Run the ActiveSync installation program if not already installed.
	• Allow USB connections inside the **Connection Settings** window of ActiveSync.

Step	Description
	For PCs with Windows Vista or Windows 7 operating system:
	• Windows Mobile Device Center starts up automatically. If it does not start automatically, start Windows Mobile Device Center.
3.	**Setting up LEICA Geo Office**
	• Start LEICA Geo Office on the office computer.
	• Open Data Exchange Manager from the Tools menu.
	• Click **Refresh (F5)** on the ActiveSync folder.

Connecting to a PC using Bluetooth step-by-step

Step	Description
1.	**Activating Bluetooth on the office computer** • The steps required depend on the Bluetooth driver and other computer specific configurations. On the office computer, always ensure that: – the correct COM port is defined. – the COM port is configured as incoming, which allows Bluetooth devices to detect the computer.
2.	**Activating Bluetooth on CS09 field controller**

Step	Description
	Turn on CS09 field controller by pressing and holding **PROG** (ON) for 2 s
	• Access the Windows CE desktop.
	• Go to **Start/Settings/Control Panel/Bluetooth Device**.
	• Click **Scan Device**.
	• Highlight the service required in the **Untrusted** box.
	• Click the **- ->** arrow to move the service to the **Trusted** box.
	• Highlight the service required in the **Trusted** box.
	• Right mouse click to access the context menu.
	• Tick **Active**.
	• Go to **Start/Settings/Control/System/Device Name** to give CS09 field controller a specific name.
	• Go to **Start/Settings/Control Panel/PC Connection**.
	• Select **Bluetooth** from the combo box.
	• Go to **Start/Programs/Communication/ActiveSync** to initialise the communication.
3.	**Setting up LEICA Geo Office**

Step	Description
	• Start LEICA Geo Office on the office computer.
	• Open Data Exchange Manager from the Tools menu.
	• Click **Refresh** (F5) on the ActiveSync folder.

8 Care and Transport

8.1 Transport

Transport in the field	When transporting the equipment in the field, always make sure that you • either carry the product in its original transport container, • or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.
Transport in a road vehicle	Never carry the product loose in a road vehicle, as it can be affected by shock and vibration. Always carry the product in its transport container and secure it.
Shipping	When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging, transport container and cardboard box, or its equivalent, to protect against shock and vibration.
Shipping, transport of batteries	When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping, contact your local passenger or freight transport company.

8.2 Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "10 Technical Data" for information about temperature limits.

Li-Ion batteries

- Refer to "10 Technical Data" for information about storage temperature range.
- At the recommended storage temperature range, batteries containing a 10% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged.
- Remove batteries from the product and the charger before storing.
- After storage recharge batteries before using.
- Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use.
- A storage temperature range of -20°C to +30°C/-4°F to 86°F in a dry environment is recommended to minimise self-discharging of the battery.

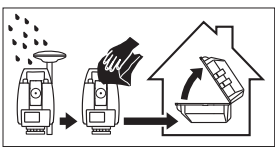
8.3 Cleaning and Drying

Product and accessories

- Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these may attack the polymer components.

Damp products

Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater than 40°C/104°F and clean them. Do not repack until everything is dry. Always close the transport container when using in the field.



Cables and plugs

Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

Connectors with dust caps

Wet connectors must be dry before attaching the dust cap.

9 Safety Directions

9.1 General Introduction

Description

The following directions enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

9.2 Intended Use

Permitted use

- Computing with software.
- Carrying out measurement tasks using various GNSS measuring techniques.
- Recording GNSS and point related data.
- Data communication with external appliances.
- Measuring raw data and computing coordinates using carrier phase and code signal from GNSS satellites.

Adverse use

- Use of the product without instruction.
- Use outside of the intended limits.
- Disabling safety systems.
- Removal of hazard notices.
- Opening the product using tools, for example screwdriver, unless this is permitted for certain functions.
- Modification or conversion of the product.
- Use after misappropriation.
- Use of products with recognisable damages or defects.
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.
- Inadequate safeguards at the working site, for example when measuring on roads.
- Controlling of machines, moving objects or similar monitoring application without additional control- and safety installations.

Warning

Adverse use can lead to injury, malfunction and damage.
It is the task of the person responsible for the equipment to inform the user about hazards and how to counteract them. The product is not to be operated until the user has been instructed on how to work with it.

9.3 Limits of Use

Environment

Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments.

Danger

Local safety authorities and safety experts must be contacted before working in hazardous areas, or close to electrical installations or similar situations by the person in charge of the product.

9.4 Responsibilities

Manufacturer of the product

Leica Geosystems AG, CH-9435 Heerbrugg, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the user manual and original accessories, in a safe condition.

Manufacturers of non Leica Geosystems accessories

The manufacturers of non Leica Geosystems accessories for the product are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Leica Geosystems product.

Person in charge of the product

The person in charge of the product has the following duties:

- To understand the safety instructions on the product and the instructions in the user manual.
- To be familiar with local regulations relating to safety and accident prevention.
- To inform Leica Geosystems immediately if the product and the application becomes unsafe.
- To ensure that the national laws, regulations and conditions for the operation of radio transmitters are respected.

Warning The person responsible for the product must ensure that it is used in accordance with the instructions. This person is also accountable for the training and the deployment of personnel who use the product and for the safety of the equipment in use.

9.5 Hazards of Use

Warning

The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can cause accidents with far-reaching human, material, financial and environmental consequences.

Precautions:

All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the product.

Caution

Watch out for erroneous measurement results if the product has been dropped or has been misused, modified, stored for long periods or transported.

Precautions:

Periodically carry out test measurements and perform the field adjustments indicated in the user manual, particularly after the product has been subjected to abnormal use and before and after important measurements.

Danger

Because of the risk of electrocution, it is dangerous to use poles and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:
Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.

Warning

During dynamic applications, for example stakeout procedures there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:
The person responsible for the product must make all users fully aware of the existing dangers.

Warning

Inadequate securing of the working site can lead to dangerous situations, for example in traffic, on building sites, and at industrial installations.

Precautions:
Always ensure that the working site is adequately secured. Adhere to the regulations governing safety and accident prevention and road traffic.

Warning

If computers intended for use indoors are used in the field there is a danger of electric shock.

Precautions:
Adhere to the instructions given by the computer manufacturer regarding field use with Leica Geosystems products.

Caution

If the accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people can sustain injury.

Precautions:
When setting-up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position.
Avoid subjecting the product to mechanical stress.

Warning

If the product is used with accessories, for example masts, staffs, poles, you may increase the risk of being struck by lightning.

Precautions:
Do not use the product in a thunderstorm.

Danger

If the product is used with accessories, for example on masts, staffs, poles, you may increase the risk of being struck by lightning. Danger from high voltages also exists near power lines. Lightning, voltage peaks, or the touching of power lines can cause damage, injury and death.

Precautions:

- Do not use the product in a thunderstorm as you can increase the risk of being struck by lightning.
- Be sure to remain at a safe distance from electrical installations. Do not use the product directly under or close to power lines. If it is essential to work in such an environment contact the safety authorities responsible for electrical installations and follow their instructions.
- If the product has to be permanently mounted in an exposed location, it is advisable to provide a lightning conductor system. A suggestion on how to design a lightning conductor for the product is given below. Always follow the regulations in force in your country regarding grounding antennas and masts. These installations must be carried out by an authorised specialist.
- To prevent damages due to indirect lightning strikes (voltage spikes) cables, for example for antenna, power source or modem should be protected with appropriate protection elements, like a lightning arrester. These installations must be carried out by an authorised specialist.
- If there is a risk of a thunderstorm, or if the equipment is to remain unused and unattended for a long period, protect your product additionally by unplugging all systems components and disconnecting all connecting cables and supply cables, for example, instrument - antenna.

Lightning conductors

Suggestion for design of a lightning conductor for a GNSS system:

1) On non-metallic structures

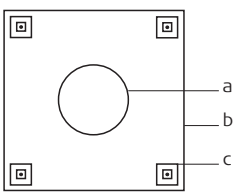
   Protection by air terminals is recommended. An air terminal is a pointed solid or tubular rod of conducting material with proper mounting and connection to a conductor. The position of four air terminals can be uniformly distributed around the antenna at a distance equal to the height of the air terminal.

   The air terminal diameter should be 12 mm for copper or 15 mm for aluminium. The height of the air terminals should be 25 cm to 50 cm. All air terminals should be connected to the down conductors. The diameter of the air terminal should be kept to a minimum to reduce GNSS signal shading.

2) On metallic structures

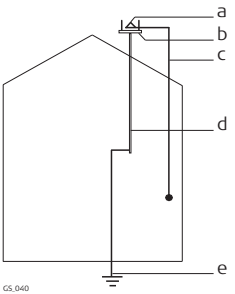
   Protection is as described for non-metallic structures, but the air terminals can be connected directly to the conducting structure without the need for down conductors.

Air terminal arrangement, plan view



a) Antenna
b) Support structure
c) Air terminal

Grounding the instrument/antenna



a) Antenna
b) Lightning conductor array
c) Antenna/instrument connection
d) Metallic mast
e) Connection to earth

Warning

Using a battery charger not recommended by Leica Geosystems can destroy the batteries. This can cause fire or explosions.

Precautions:

Only use chargers recommended by Leica Geosystems to charge the batteries.

Caution

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

Precautions:
Before shipping the product or disposing of it, discharge the batteries by running the product until they are flat.
When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping contact your local passenger or freight transport company.

Warning

High mechanical stress, high ambient temperatures or immersion into fluids can cause leakage, fire or explosions of the batteries.

Precautions:
Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.

Warning

If battery terminals come in contact with jewellery, keys, metallised paper or other metals, short circuited battery terminals can overheat and cause injury or fire, for example by storing or transporting in pockets.

Precautions:
Make sure that the battery terminals do not come into contact with metallic objects.

Warning

Incorrect fastening of the external antenna to vehicles or transporters poses the risk of the equipment being broken by mechanical influence, vibration or airstream. This may result in accident and physical injury.

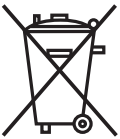
Precautions:
Attach the external antenna professionally. The external antenna must be secured additionally, for example by use of a safety cord. Ensure that the mounting device is correctly mounted and able to carry the weight of the external antenna (>1 kg) safely.

Warning

If the product is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorised persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.

Precautions:



The product must not be disposed with household waste.
Dispose of the product appropriately in accordance with the national regulations in force in your country.
Always prevent access to the product by unauthorised personnel.

Product-specific treatment and waste management information can be downloaded from the Leica Geosystems home page at http://www.leica-geosystems.com/treatment or received from your Leica Geosystems dealer.

Warning

Only Leica Geosystems authorised service workshops are entitled to repair these products.

9.6 Electromagnetic Compatibility EMC

Description

The term Electromagnetic Compatibility is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances to other equipment.

Warning

Electromagnetic radiation can cause disturbances in other equipment.

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

Caution

There is a risk that disturbances may be caused in other equipment if the product is used with accessories from other manufacturers, for example field computers, personal computers, two-way radios, non-standard cables or external batteries.

Precautions:

Use only the equipment and accessories recommended by Leica Geosystems. When combined with the product, they meet the strict requirements stipulated by the guidelines and standards. When using computers and two-way radios, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

Caution

Disturbances caused by electromagnetic radiation can result in erroneous measurements.
Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that the product may be disturbed by intense electromagnetic radiation, for example, near radio transmitters, two-way radios or diesel generators.

Precautions:
Check the plausibility of results obtained under these conditions.

Warning

If the product is operated with connecting cables attached at only one of their two ends, for example external supply cables, interface cables, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired.

Precautions:
While the product is in use, connecting cables, for example product to external battery, product to computer, must be connected at both ends.

Radios or digital cellular phones

Use of product with radio or digital cellular phone devices:

Warning

Electromagnetic fields can cause disturbances in other equipment, in installations, in medical devices, for example pacemakers or hearing aids and in aircraft. It can also affect humans and animals.

Precautions:
Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment can be disturbed or that humans or animals can be affected.

- Do not operate the product with radio or digital cellular phone devices in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
- Do not operate the product with radio or digital cellular phone devices near to medical equipment.
- Do not operate the product with radio or digital cellular phone devices in aircraft.

9.7 FCC Statement, Applicable in U.S.

The greyed paragraph below is only applicable for products without radio.

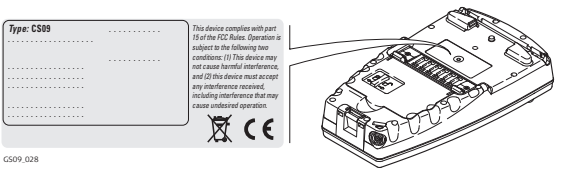
Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules.
These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

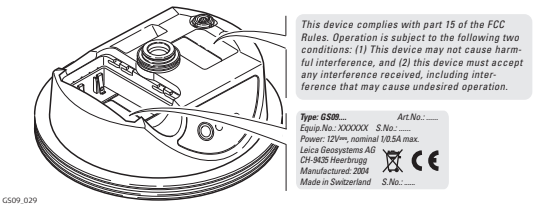
Warning Changes or modifications not expressly approved by Leica Geosystems for compliance could void the user's authority to operate the equipment.

Labelling CS09


Type: CS09
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
CE

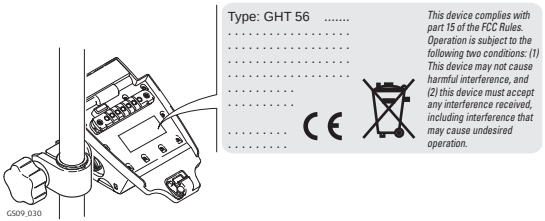
GS09_028

Labelling GS09


This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Type: GS09.... Art.No.: .....
Equip.No.: XXXXXX S.No.: .....
Power: 12V⎓, nominal I.0.5A max.
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: 2004
Made in Switzerland S.No.: .....
CE

GS09_029

Labelling GHT56


Type: GHT 56 .....
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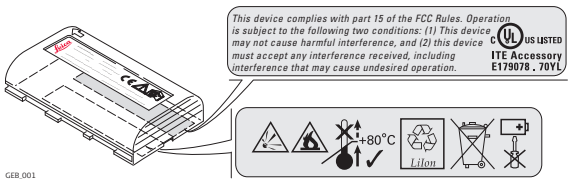
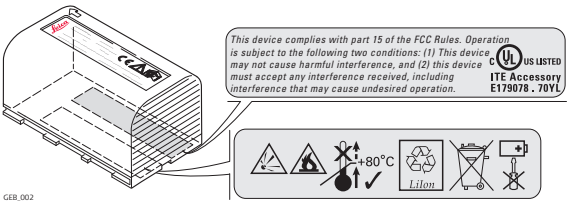
CE
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
GS09_030

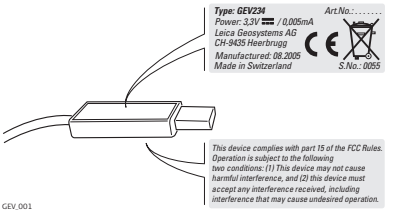
Labelling internal battery GEB211, GEB212


This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
c UL us LISTED
ITE Accessory
E179078 . 70YL
+80°C
LiIon
GEB_001

Labelling internal battery GEB221


This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
US LISTED
ITE Accessory
E179078 . 70YL
+80°C
Lilon
GEB_002

Labelling USB cable GEV234


Type: GEV234
Art.No.: .....
Power: 3,3V ⎓ / 0,005mA
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: 08.2005
Made in Switzerland
S.No.: 0055
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
GEV_001

10 Technical Data

10.1 CS09 Technical Data

Design

Glass reinforced polymer housing with integrated battery.

Control unit

Display:	1/4 VGA (320 x 240 pixels), color, graphics capable LCD, illumination, touch screen
Keyboard:	62 keys including 12 function keys, illumination
Angle Display:	360°'", 360° decimal, 400 gon, 6400 mil, V %
Distance Display:	m, ft int, ft us, ft int inch, ft us inch
Touch screen:	Toughened film on glass

Dimensions

Type	Length [m]	Width [m]	Thickness [m]
CS09	0.218	0.123	0.047

Weight

Type	Weight [kg]/[lbs]
CS09 with internal battery	0.741/1.634

Recording

Data can only be recorded on the CompactFlash card.

Type	Capacity [MB]	Data capacity
CompactFlash card	• 256 • 1024	256 MB is sufficient for about 360000 real-time points with codes

Power

Type	Consumption [W]	External supply voltage
CS09	1.4 Bluetooth to GS09, radio receiving data	Nominal voltage 12 V DC (⎓) Voltage range 10.5 V-28 V

Internal battery

Type	Battery	Voltage	Capacity	Operating time, typical
CS09	Li-Ion	7.4 V	GEB211: 2.2 Ah	11 h Bluetooth to GS09
CS09	Li-Ion	7.4 V	GEB212: 2.6 Ah	13 h Bluetooth to GS09

Environmental specifications

Temperature

Type	Operating temperature [°C]	Storage temperature [°C]
CS09	-30 to +65 Bluetooth: -25 to +65 Color display: -30 to +50	-40 to +80
Internal battery	-20 to +50	-40 to +70

Protection against water, dust and sand

Type	Protection
CS09	IP67 (IEC60529) Dusttight Waterproof to 1 m temporary immersion

Humidity

Type	Protection
CS09	Up to 100 % The effects of condensation are to be effectively counteracted by periodically drying out CS09.

Interfaces

Type	USB	Bluetooth
CS09	LEMO port	Class 2

Connector

- 8 pin LEMO-1
- 7 pin clip-on-contacts

10.2 GS09 Technical Data

10.2.1 Tracking Characteristics

Antenna technology

SmartTrack+

Satellite reception

Dual frequency

Antenna channels

14 channels continuous tracking on L1 and L2 (GPS); twelve channels continuous tracking on L1 and L2 (GLONASS).

Supported codes

GPS

L1	L2
Carrier phase, C/A code	Carrier phase, C code (L2C) and P2 code

GLONASS

L1	L2
Carrier phase, C/A code	Carrier phase, P2 code

Carrier tracking

GPS

Condition	GS09
L1, AS off or on	Reconstructed carrier phase via C/A code
L2, AS off	Reconstructed carrier phase via P2 code
L2, AS on	Switches automatically to patented P code-aided technique providing full L2 reconstructed carrier phase

GLONASS

Condition	GS09
L1	Reconstructed carrier phase via C/A code
L2	Reconstructed carrier phase via P2 code

Code measurements

GPS

Condition	GS09
L1, AS off L1, AS on	Carrier phase smoothed code measurements: C/A code
L2, AS off	Carrier phase smoothed code measurements: P2 code

Condition	GS09
L2, AS on	Carrier phase smoothed code measurements: Patented P code-aided code

GLONASS

Condition	GS09
L1	Carrier phase smoothed code measurements: C/A code
L2	Carrier phase smoothed code measurements: P2 code

☞ Carrier phase and code measurements on L1 and L2 are fully independent with AS on or off.

Satellites tracked Up to 14 simultaneously on L1 and L2 (GPS) + up to 12 simultaneously on L1 and L2 (GLONASS)

10.2.2 Accuracy

Accuracy is dependent upon various factors including the number of satellites tracked, constellation geometry, observation time, ephemeris accuracy, ionospheric disturbance, multipath and resolved ambiguities.

The following accuracies, given as **r**oot **m**ean **s**quare, are based on measurements processed using LGO and on real-time measurements.

Differential code

The baseline precision of a differential code solution for static and kinematic surveys is 25 cm.

Differential phase in post-processing

Static		Kinematic	
Horizontal	**Vertical**	**Horizontal**	**Vertical**
5 mm + 0.5 ppm	10 mm + 0.5 ppm	10 mm + 1 ppm	20 mm + 1 ppm

Differential phase in real-time

Static		Kinematic	
Horizontal	**Vertical**	**Horizontal**	**Vertical**
5 mm + 0.5 ppm	10 mm + 0.5 ppm	10 mm + 1 ppm	20 mm + 1 ppm

10.2.3 Technical Data

Dimensions	Height: Diameter:	0.089 m 0.186 m
Connector	• 8 pin LEMO-1 • 5 pin SmartStation clip-on contacts	
Mounting	5/8" Whitworth	
Weight	1.1 kg including internal battery	
Power	Power consumption: External supply voltage:	1.8 W typically Nominal 12 V DC (⎓), voltage range 10.5 V-28 V
Battery internal	Type: Voltage: Capacity: Typical operating time:	Li-Ion 7.4 V GEB211: 2.2 Ah GEB212: 2.6 Ah 7 h The given operating times are valid for • one fully charged GEB212 battery.

- 25°C. Operating times will be shorter when working in cold weather.

Satellite tracking data

Type	GS09
Frequency	GPS L1 1575.42 MHz GPS L2 1227.60 MHz GLONASS L1 1602.5625-1611.5 MHz GLONASS L2 1246.4375-1254.3 MHz
Gain	Typically 27 dBi
Noise Figure	Typically < 2 dBi

Environmental specifications

Temperature

Operating temperature [°C]	Storage temperature [°C]
-40 to +65 Bluetooth: -30 to +65	-40 to +80

Protection against water, dust and sand

Protection
IP67 (IEC 60529)
Dusttight
Protected against water jets
Waterproof to 1 m temporary immersion

Humidity

Protection
Up to 100 %
The effects of condensation are to be effectively counteracted by periodically drying out the antenna.

10.3 GHT56 Technical Data

Dimensions

Length:	0.169 m
Width:	0.123 m
Thickness:	0.130 m

Connector

- 8 pin LEMO-1
- 7 pin clip-on-contacts

Weight

0.460 kg including internal battery GEB211/GEB212

Power

Power consumption:	Nominal voltage 7.4 V DC (⎓) / 2.0 A max

Battery

Type:	Li-Ion
Voltage:	7.4 V
Capacity:	GEB211: 2.2 Ah, GEB212: 2.6 Ah, GEB221: 4.4 Ah
Typical operating time:	16 h The given operating times are valid for • one fully charged GEB221 battery. • 25°C. Operating times will be shorter when working in cold weather. • good data link.

- GFU14 or GFU27 modem connected

Environmental specifications

Temperature

Operating temperature [°C]	Storage temperature [°C]
-20 to +65	-40 to +80

Protection against water, dust and sand

Protection
IP67 (IEC 60529)
Dusttight
Protected against water jets
Waterproof to 1 m temporary immersion

Humidity

Protection
Up to 100 %
The effects of condensation are to be effectively counteracted by periodically drying out the holder.

10.4 Conformity to National Regulations

Conformity to national regulations

For products which do not fall under R&TTE directive:

Hereby, Leica Geosystems AG, declares that the product/s is/are in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity can be consulted at http://www.leica-geosystems.com/ce.

10.4.1 CS09

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the product CS09 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity can be consulted at http://www.leica-geosystems.com/ce.

  Class 1 equipment according European Directive 1999/5/EC (R&TTE) can be placed on the market and be put into service without restrictions in any EEA member state.
- The conformity for countries with other national regulations not covered by the FCC part 15, 22 and 24 or European directive 1999/5/EC has to be approved prior to use and operation.

Frequency band

Bluetooth	2402 - 2480 MHz

Output power

Bluetooth	2.5 mW

Antenna

Type	Antenna	Gain [dBi]	Connector	Frequency band [MHz]
CS09, Bluetooth	Integrated antenna	-	-	-

10.4.2 GS09

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the product GS09 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity can be consulted at http://www.leica-geosystems.com/ce.

Class 1 equipment according European Directive 1999/5/EC (R&TTE) can be placed on the market and be put into service without restrictions in any EEA member state.

- The conformity for countries with other national regulations not covered by the FCC part 15, 22 and 24 or European directive 1999/5/EC has to be approved prior to use and operation.

Frequency band

Type	Frequency band [MHz]
GS09	1227.60 1575.42 1246.4375 - 1254.3 1602.4375 - 1611.5
Bluetooth	2402 - 2480

Output power

Type	Output power [mW]
GNSS	Receive only
Bluetooth	5

Antenna

GNSS Bluetooth	Internal GNSS antenna element (receive only) Type: Internal Microstrip antenna Gain: 1.5 dBi

10.4.3 GFU24, Siemens MC75

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the GFU24 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at http://www.leica-geosystems.com/ce.

Class 1 equipment according European Directive 1999/5/EC (R&TTE) can be placed on the market and be put into service without restrictions in any EEA Member state.

- The conformity for countries with other national regulations not covered by the FCC part 15, 22 and 24 or European directive 1999/5/EC has to be approved prior to use and operation.

Frequency band

Quad-Band EGSM850 MHz/ EGSM900 MHz/ GSM1800 MHz/ GSM1900 MHz

Output power

EGSM850/900:	2 W
GSM1800/1900:	1 W

Antenna

Type	GAT 3	GAT 5	GAT 18
Frequency band [MHz]	890 - 960 / 1710 - 1880 / 1920 - 2170	824 - 894 / 1850 - 1990	824 - 894 / 890 - 960 / 1710 - 1880 / 1850 - 1990 / 1920 - 2170
Type	Detachable λ/2 antenna	Detachable λ/2 antenna	Detachable λ/2 antenna
Connector	TNC	TNC	TNC

Specific Absorption Rate (SAR)

The product meets the limits for the maximum permissible exposure of the guidelines and standards which are force in this respect. The product must be used with the recommended antenna. A separation distance of at least 20 centimetres should be kept between the antenna and the body of the user or nearby person within the intended application.

10.4.4 GFU19 (US), GFU25 (CAN) CDMA MultiTech MTMMC-C

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- The conformity for countries with other national regulations not covered by the FCC part 15, 22 and 24 has to be approved prior to use and operation.

Frequency band

Dual-Band CDMA850 MHz/CDMA1900 MHz

Output power

CDMA850: 2 W
CDMA1900: 0.4 W

Antenna

Type	GAT 5	GAT 18
Frequency band [MHz]	824 - 894 / 1850-1990	824 - 894 / 890 - 960 / 1710 - 1880 / 1850 - 1990 / 1920 - 2170
Type	Detachable λ/2 antenna	Detachable λ/2 antenna
Connector	TNC	TNC

Specific Absorption Rate (SAR)	The product meets the limits for the maximum permissible exposure of the guidelines and standards which are force in this respect. The product must be used with the recommended antenna. A separation distance of at least 20 centimetres should be kept between the antenna and the body of the user or nearby person within the intended application.

10.4.5 GFU28, Telit UC864-G

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- Hereby, Leica Geosystems AG, declares that the GFU28 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted at http://www.leica-geosystems.com/ce.

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- The conformity for countries with other national regulations not covered by the FCC part 15, 22 and 24 or European directive 1999/5/EC has to be approved prior to use and operation.

Frequency band

UMTS/HSDPA (WCDMA/FDD) 850 MHz/ 1900 MHz/ 2100 MHz
Quad-Band EGSM 850 MHz/ 900 MHz/ 1800 MHz/ 1900 MHz
GPRS multi-slot class 12
EDGE multi-slot class 12

Output power

EGSM850/900:	2 W
GSM1800/1900:	1 W
UMTS2100:	0.25 W
EDGE850/900:	0.5 W

EDGE1800/1900: 0.4 W

Antenna

Type	Internal	GAT 3	GAT 5	GAT 18
Frequency band [MHz]	824 - 894 / 890 - 960 / 1710 - 1880 / 1850 - 1990 / 1920 - 2170	890 - 960 / 1710 - 1880 / 1920 - 2170	824 - 894 / 1850 - 1990	824 - 894 / 890 - 960 / 1710 - 1880 / 1850 - 1990 / 1920 - 2170
Type	Internal	Detachable λ/2 antenna	Detachable λ/2 antenna	Detachable λ/2 antenna
Connector	-	TNC	TNC	TNC

Specific Absorption Rate (SAR)

The product meets the limits for the maximum permissible exposure of the guidelines and standards which are force in this respect. The product must be used with the recommended antenna. A separation distance of at least 20 centimetres should be kept between the antenna and the body of the user or nearby person within the intended application.

11 International Limited Warranty, Software Licence Agreement

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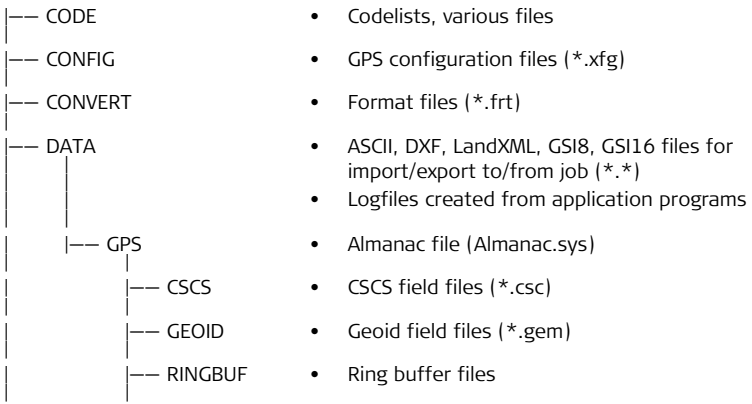
Appendix A Directory Structure of the Memory Device

Description

Files are stored in specific directories on the CompactFlash card. The following diagram indicates the directory structure.

Directory structure



├── DBX	• Job files, various files • DTM jobs, various files • Coordinate system file (Trfset.dat)
├── GPS	• Antenna file (List.ant) • GSM/Modem station list (Stations1200.fil)
├── GSI	• GSI files (*.gsi) • ASCII files for export from job (*.*)
├── SYSTEM	• Application program files (*.a*) • Firmware files (*.fw) • Language files (*.s*) • Licence file (*.key) • System files (System.ram)

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- when it has to be **right**

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